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OPERATING EXPERIENCE WEEKLY SUMMARY

Office of Nuclear and Facility Safety

January 15 - January 21, 1999

Summary 99-03

Operating Experience Weekly Summary 99-03

January 15 through January 21, 1999

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EVENTS

1. WALL PENETRATION SEVERS 24-V ELECTRICAL LINE

On January 14, 1999, at the Los Alamos National Laboratory (LANL), a subcontracted construction and electrical crew cut through the exterior wall of a metal building and severed a 24-V electrical line that serviced a manual fire alarm pull station, compromising the facility safety status. Electrical crew personnel immediately informed facility management and the appropriate facility coordinator. Facility management then stopped all penetration work. Construction and electrical crew personnel noticed the pull station mounted on the inside wall of the building but did not attempt to determine the exact location of the concealed electrical line before beginning work. Although no injuries resulted, failure to identify the conduit location before cutting caused minor facility-equipment damage and could have caused personnel injury. (ORPS Report ALO-LA-LANL-PHYSCOMPLX-1999-0001)

Investigators determined that the construction crew was cutting through the exterior wall of the building in order to create a doorway and install a doorframe. They also determined that before penetrating the wall, the crew performed a visual inspection and noted the pull station in the vicinity of the penetration area. The crew used double-insulated tools connected to ground-fault circuit-interrupters, wore appropriate construction-site personnel protective equipment, and used a skill saw that had a nonconductive blade set to penetrate to a maximum depth of 1 1/8 inch. The crew had made two vertical cuts from the outside of the building, through the corrugated steel facing, without incident, but they severed both the conduit and electrical wiring when they subsequently made a horizontal cut. Investigators determined that the conduit and wiring were unusually close to the exterior wall surface. They also determined that the health and safety guidance for this project was provided in the appropriate LANL documentation, the contractors' Health and Safety Plan, the associated activity hazard analyses, and a Memorandum of Understanding between the Facility Management Unit and the subcontractor.

Facility managers conducted a critique of the event. Critique members included the construction subcontractor superintendent, project management, electrical foremen, facility management, occurrence investigators, and a DOE facility representative. They identified the following issues.

- No one adequately assessed the hazards before cutting into the wall. The crew knew a conduit ran somewhere along the area that they wanted to cut into, but they did not make portholes to visually locate the actual conduit path.

- No one had consistent understanding of what was meant by "blind penetration." The subcontractor believed a blind penetration was a concrete penetration deeper than 1½ inches, and that additional requirements associated with performing blind penetrations were not necessary because the skill saw being used was set to penetrate to a maximum depth of 1 1/8 inches. However, LANL procedures define a blind penetration as a penetration where there is no visual indication of what is behind the surface being penetrated.

- Subcontractors generally believe that penetrations 1½ inches deep or less do not require special permits or assessments. Critique members determined that this accepted practice should be further investigated to determine if it compromises safety.

- Workers had previously performed this type of work by cutting from the inside of the exterior wall towards the outside. Critique members believed that this method was safer than cutting from the outside of the wall towards the inside because the wall support system on the inside of the wall would be visible and workers could better detect the presence of conduit.

- No one developed adequate procedures for the penetration hazard assessment process or developed adequate controls to abate the penetration hazards.

Subcontractor personnel will revise their wall penetration checklist and procedures before further wall penetration activity occurs. The construction manager and facility managers will review and approve the procedures when the changes are completed.

An October 1998 Environment, Safety and Health audit, *Follow-up Review of the 1996 Integrated Safety Management Evaluation at Fernald Environmental Management Project*, EH2PUB/10-98/04OIT, identified a weakness in a penetration permit procedure that had been revised by Fernald personnel following three subcontractor penetration events in December 1997. The revised procedure allowed facility personnel to make 1¼ inch deep floor, ceiling, and wall penetrations without requiring additional guidance or checking for (1) outlet boxes, (2) switches, (3) fixtures, or (4) power panels. However, on February 23, 1998, four days after the procedure was revised, workers drilled a 1¼ inch deep hole in the side of a trailer to hang a sign and penetrated an energized 240-V line that was not installed in accordance with the National Electrical Code. (ORPS Report OH-FN-FDF-FEMP-1998-0006) Although the penetration permitting process was improved by the procedural changes, evaluators believe that the procedural requirements and cautions associated with the use of a 1¼ inch blind penetration allowance in floors, ceilings, and walls were inadequate and could place workers at risk.

NFS has reported similar occurrences where workers penetrated building surfaces and damaged hidden utilities. Following are some examples.

- Weekly Summary 98-43 reported that a construction subcontractor at the Idaho National Engineering Environmental Laboratory severed an energized 220-V, 20-amp evacuation siren electrical circuit while drilling through a composite steel/masonry block wall. Investigators determined that the conduit was concealed between the exterior steel siding and the building masonry block. (ORPS Report ID--LITC-TRA-1998-0019)

- Weekly Summary 97-47 reported that a construction worker at Rocky Flats severed an energized 120-V line while core-drilling a concrete wall. Investigators determined that the subcontractor construction manager approved the core-drilling based on an exemption letter written by engineering personnel, without a technical review. They also determined that he failed to obtain engineering personnel approval. (ORPS Report RFO--KHLL-371OPS-1997-0099)

These events underscore the importance of using effective work control practices and detailed pre-job planning for construction activities. The responsibility for ensuring adequate planning and control of work activities resides with line management. Managers should ensure that work control processes are followed and facility practices are enforced. Safety and health hazard analysis must be included in the work control process to help prevent worker injury and should include provisions for drawing reviews, job-specific walk-downs, personnel protective equipment, and the use of equipment to detect embedded conduit. Pre-job briefings, facility procedures, and training programs should emphasize the dangers associated with penetration activities.

DOE facility managers should ensure that personnel understand the basics of work control practices and work planning. Following are some documents that provide guidance for the performance of work where the potential of concealed utilities exists.

- Lessons Learned Report, Issue 98-02, *Penetrating Hidden Utilities,* includes lessons learned from events that involved cutting and drilling into utilities concealed behind walls, floors, and ceilings. It also provides recommendations to avoid hidden utilities and includes useful references. Lessons Learned Reports are available at http://www.tis.eh.doe.gov/web/oeaf/lessons_learned/reports/.

- 29 CFR 1926.416(a)(3), *Protection of Employees*, states that employers shall ascertain by inquiry, direct observation, or by instruments whether any part of an energized electrical circuit is located such that the performance of work may bring any person, tool, or machine into contact with the electrical circuit. OSHA regulations define concealed wiring as wiring rendered inaccessible by the structure or finish of the building. OSHA regulations are available at http://www.osha-slc.gov/OshStd_data.

- DOE/EH-0557, Safety Notice 98-01, *Electrical Safety*, contains summaries, corrective actions, and recommendations related to electrical events. It addresses performing work in proximity to concealed utilities and provides measures that should be taken where a possibility of concealed utilities exists. Safety Notices are available at http://tis.eh.doe.gov/web/oeaf/lessons_learned/ons/ ons.html.

KEYWORDS: electrical safety, hazard analysis, penetration, permit

FUNCTIONAL AREAS: Construction, Industrial Safety, Modifications

2. POTENTIAL UNREVIEWED SAFETY QUESTION ON FIRE SUPPRESSION SYSTEM

On January 6, 1999, at the Oak Ridge Y-12 Site, the facility manager for an enriched uranium operations building identified a potential unreviewed safety question (USQ) associated with the use of a fire department pumper truck to boost the water pressure in a sprinkler system in order to clear a system pressure alarm. Investigators determined that this type of evolution could impact system operability because the increased pressure could affect pressure alarm signal(s), deadheading the suppression system. Failure to thoroughly evaluate the effect of increased pressure on the fire suppression system could result in equipment damage or affect facility safety. (ORPS Report ORO--LMES-Y12NUCLEAR-1999-0003)

On December 23, 1998, plant management sent all non-essential personnel home because of a worsening ice storm. After personnel had left, a master box for a fire suppression system alarmed and could not be reset. Firefighters determined that pressure fluctuations had caused the alarm. They tried to reset the pressure switch but were unable to, so they attempted to use the pumper truck to boost the sprinkler system water pressure. They connected it to the system and boosted the system pressure by approximately 15 pounds, but the alarm failed to clear. The firefighters then disconnected the pumper truck and continued troubleshooting.

Enriched uranium operations managers held a meeting to gather facts and information. They determined that use of the pumper truck should be analyzed by the USQ determination process to determine if a USQ exists. They directed facility personnel to perform the USQ determination

for all enriched uranium operations authorization basis documents and for LCO fire protection systems. They determined that the practice of using the pumper truck to boost system pressure during maintenance conditions would have been acceptable if it had been performed in accordance with procedures and under the control of a work package. Investigators determined that this had not been done. During a fire, firefighters can connect the pumper truck to the suppression system to provide additional pressure while the system is spraying water to combat the fire.

The master box alarm on December 23 also led to two Operations Safety Requirement (OSR) violations. Firefighters believe that, in addition to the suspected pressure surge, a restricted system retard chamber drain did not allow accumulated water to drain, resulting in an OSR violation. The retard chamber is designed to prevent false alarm indications of flow in the system caused by supply line pressure fluctuations. To correct the suspected cause of the problem, maintenance personnel closed a post-indicator valve, which removed the suppression system from service. When they performed this action they exceeded the scope of the emergency work package, which only permitted clearing the retard chamber drain. Additionally, firefighters failed to inform the plant shift superintendent and facility management that the suppression system was out of service, which delayed the establishment of fire patrols and resulted in the LCO one-hour time frame being exceeded. Failure to implement this compensatory measure resulted in the first operational safety requirement violation. (ORPS Report ORO--LMES-Y12NUCLEAR-1998-0098)

The second violation occurred when a shift manager directed the plant shift superintendent to enter an LCO action step that was not appropriate for the situation. The shift manager believed the action step, which required stationing a fire protection inspector at the master box to monitor incoming alarm signals on an annunciator light panel, was correct. However, discussions held on January 5 between enriched uranium operations personnel, Y-12 fire department personnel, and DOE personnel revealed that the master box annunciator panel flow switch indicator lights may not indicate system operability, as previously believed. Facility personnel will continue to evaluate this event and will also determine if a potential USQ determination should be filed. (ORPS Report ORO--LMES-Y12NUCLEAR-1999-0001)

This event identified several problems associated with the operation and maintenance of OSR-required equipment and systems. Facility managers need to be informed of any change in the operational status of these systems so they can implement compensatory actions within the required time frames governed by LCOs. Facility managers and shift supervisors need to have a clear understanding of the LCOs and must know which ones are appropriate for any given condition. Maintenance activities should be controlled by procedure and performed in accordance with a work package.

DOE facility managers should ensure that appropriate compensatory measures are taken and maintained when systems become inoperable because of failures, when required maintenance is being performed, or when surveillance requirements are not met. DOE O 5480.22, *Technical Safety Requirements*, states that LCOs “establish the lowest functional capability or performance levels of equipment required for normal safe operation of the facility.” When an LCO is not met, remedial actions (as defined by the technical safety requirements) must be taken either to restore the system or component to an operable status or to place the facility in a mode in which the system or component is not required for continued safe operation. Violations of technical safety requirements occur as a result of (1) exceeding safety limits, (2) failing to take actions required within a required time limit, (3) failing to perform surveillances within a required time limit, and (4) failing to comply with administrative control requirements.

KEYWORDS: fire protection, fire suppression, limiting conditions for operations, operational safety requirement, violation

FUNCTIONAL AREAS: Fire Protection, Licensing/Compliance

3. LEGACY URANIUM CHIP DRUMS OPENED WITHOUT THE APPROPRIATE WORK CONTROLS IN PLACE

On December 5, 1998, at the Rocky Flats Environmental Technology Site Non-Plutonium Operations Area, a radiological control technician opened four 55-gallon drums and two 10-gallon drums without the appropriate work controls in place. He opened the drums to determine the contents in response to lessons learned from the 1997 Hanford explosion incident (ORPS Report RL--PHMC-PFP-1997-0023). The technician determined that two of the 55-gallon drums contained depleted uranium chips coated in a clear liquid and the other two 55-gallon drums each contained 20-gallon drums (one of which was leaking a clear fluid). The two 10-gallon drums contained cans labeled as uranium chips. The drums were stored in the chip roaster room, which is a rarely entered airborne radioactivity area. This event was not discovered until January 8, 1999, during a meeting to review the procedure for sampling drums to verify their contents. Investigators determined that no Integrated Work Control Program work package or procedure was used. They determined that facility personnel permitted the technician to open the drums because they thought they knew the contents of the drums and associated hazards based on process knowledge. Performing work without the appropriate work controls can result in worker exposure to unplanned hazards. (ORPS Report RFO--KHLL-NONPUOPS2-1999-0001)

Investigators believe that the drums have been stored undisturbed in the room for 10 to 15 years. They also believe that the liquid is machine oil because historically the drums were permitted in the chip roaster room only after they had been loaded with machining chips. The roaster was previously used to oxidize the depleted uranium chips. Investigators determined that the radiological control technician attended a pre-evolution briefing for this work. In this briefing, safety, radiological requirements, and actions to be taken if a pyrophoric reaction occurs were discussed. They also determined that he wore anti-contamination clothing and an air purifying respirator, as required by the radiological work permit, and that the work was entered as a write-in on the plan of the day. Because of the discussion held during the pre-evolution brief, the technician also wore leather gloves and carried a radio for emergency communication. Investigators determined that the radiological work permit was not an adequate work control document for opening the drums and that the technician should have used an approved work control mechanism and not relied on outdated process knowledge. However, no adverse operational or health effects resulted from this event.

The facility manager held a fact-finding meeting on this event. Meeting attendees learned that on January 8, 1999, facility personnel were reviewing a procedure to verify and sample the drum contents when they discovered that the radiological control technician had opened the drums in December. They also learned that if the chips not been coated with machine oil, or if the oil had settled to the bottom of the drums, opening the drums could have resulted in chip oxidation and led to sparking or a fire. The facility manager will continue to review this event and will develop corrective actions as necessary.

NFS has reported several events that resulted in unexpected hazards involving legacy material. Following are some examples.

- Weekly Summary 98-42 reported that a worker at the Rocky Flats Environmental Technology Site was size-reducing a glovebox inside a soft-sided containment tent when a pyrophoric reaction occurred, resulting in flames being emitted from a furnace vacuum pipe that he was cutting. Investigators believe that the vacuum pipe contained plutonium hydride that was covered by an oxide layer and that when the band saw cut through the pipe the oxide layer was displaced, exposing

the plutonium hydride to air and causing it to ignite. They also determined that the flames resulted in an estimated 1.6 million derived air concentration inside the tent. (ORPS Report RFO--KHLL-779OPS-1998-0038)

- Weekly Summary 98-07 reported that a Savannah River Analytical Laboratory facility manager reported inadequate preparation and review of work documents that resulted in worker exposure to higher-than-expected contamination levels during decontamination and remediation activities. Radiological control technicians surveyed a laboratory following glovebox removal and discovered contamination levels up to 1,000,000 dpm alpha and 20,000 dpm beta-gamma from metal filing residue when they cut through a stainless-steel vacuum line that contained legacy plutonium contamination. Work planners had not anticipated activity levels of this magnitude from this work. Investigators determined that inadequate reviews of the work documents caused the workers to be exposed to unexpected high contamination levels. (ORPS Report SR--WSRC-ALABF-1998-0001)

- Weekly Summary 95-12 reported that a radiological control technician at the Los Alamos National Laboratory Firing Sites and High Explosives Laboratory discovered three subcontractors working in a contaminated soil area that contained depleted uranium. The workers had not been notified of the hazards associated with the area, where explosives containing depleted uranium had once been detonated. Investigators determined that radiological control personnel did not perform an adequate review and did not address the presence of legacy contaminated soil at the work site. (ORPS Report ALO-LA-LANL-FIRNGHELAB-1995-0008)

These events highlight the need for facility managers to verify that work control documents address the hazards of handling material that has been packaged and stored for several years. This includes performing safety and health reviews, together with design, fabrication, inspection, and maintenance of containers. These elements help prevent equipment failures or human errors that might lead to a fire, an explosion, or a release of contaminated materials. Because past facility operations may not have been conducted in a manner consistent with today's practices and requirements, it would not be unusual to find conditions different from those documented. Although the use of process knowledge can be helpful, this knowledge must be current and accurate before it is relied upon. When process knowledge is gained from secondary sources or is assumed from what may be incomplete knowledge of past operations, additional safety precautions should be implemented. In addition, workers need to be aware of the hazards associated with storing, opening, and handling legacy waste containers. Facility managers must develop appropriate programs and procedures to identify all associated hazards before performing work.

Although the depleted uranium chips in the Rocky Flats event were in a safe configuration, facility personnel should be aware of the importance of using caution when working with pyrophoric metals. Personnel involved in such activities should fully understand the potential reactions associated with the materials. Hazards that could cause or contribute to the severity of a combustible metal fire should be identified by a hazard analysis, and measures to minimize the hazards should be implemented. Metal corrosion and radiolytic decay of hydrogenous materials in the waste can be a significant source of hydrogen generation. However, based on the rate of decay of depleted uranium, hydrogen generation is unlikely.

Facility managers should review the following documents to ensure that practices and procedures are adequately implemented.

- DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter XVI, "Operations Procedures," states that operations procedures should provide direction to ensure that the facility is operated safely and within its design basis.

The Order states that "procedures should be developed for all anticipated operations, evolutions . . . and . . . should provide administrative and technical direction to conduct the intent of the procedure effectively."

- DOE-HDBK-1081-94, *Primer on Spontaneous Heating and Pyrophoricity*, provides information for the identification and prevention of potential spontaneous combustion hazards. The handbook contains information on the effects that atmospheric oxygen, moisture, heat transfer, and specific areas have on spontaneous heating and ignition. It also identifies metals and gases known to be pyrophoric, acceptable methods for long-term storage, proper extinguishing agents, and additional sources of reference materials available on these subjects. The handbook can be obtained at http://www.doe.gov/html/techstds/standard/standard.html.

- National Fire Protection Association, *Fire Protection Handbook*, chapter 4-16, "Metals," provides guidance on the fire hazard properties of combustible metals, including uranium. It states that uranium is subject to spontaneous ignition and that fires have occurred spontaneously after prolonged exposure to moist air. Ordering information for NFPA documents may be found on the NFPA home page at http://www.nfpa.org.

- DOE/NS-0013, Safety Notice 93-1, "Fire, Explosion, and High-Pressure Hazards Associated with Waste Drums and Containers," February 1993, describes lessons learned on safe storage and handling of waste containers and drums. The Notice specifically discusses handling, storing, venting, and opening containers suspected of being pressurized or containing flammable vapors. It can be obtained by contacting the ES&H Information Center, (800) 473-4375, or by writing to U.S. Department of Energy, ES&H Information Center, EH-72, 19901 Germantown Rd., Germantown, MD 20874. Safety Notices are also available at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

- The *Hazard and Barrier Analysis Guide* discusses barriers that provide controls over the hazards associated with a job. Barriers may be physical barriers, procedural or administrative barriers, or human action. The reliability of barriers is important in preventing undesirable events such as fires. The reliability of a barrier is determined by its ability to resist failure. Barriers can be imposed in parallel to provide defense-in-depth and to increase the margin of safety. The *Guide* provides a detailed analysis for selecting optimum barriers, including a matrix that displays the effectiveness of different barriers in protecting against some common hazards. A copy of *The Hazard and Barrier Analysis Guide* is available at http://tis.eh.doe.gov:80/web/oeaf/tools/hazbar.pdf.

KEYWORDS: uranium, pyrophoric materials, procedures

FUNCTIONAL AREAS: Hazards Analysis, Procedures, Material Handling/Storage

4. MISLABELED WASTE DRUM SENT OFF-SITE

On January 13, 1999, a subcontracted private waste disposal facility notified the Idaho Nuclear Technology and Engineering Center (INTEC) waste shipping group that a 30-gallon drum of hazardous waste that INTEC had shipped to the subcontractor's facility was not correctly labeled. The subcontractor determined that although the drum contained 40 liters of waste with a pH of 0.86, it had not been labeled as corrosive waste. A check of facility records associated with the

shipment containing the drum indicated that INTEC had not neutralized the waste before shipping it from the site. Although there were no adverse consequences from this occurrence, incorrect waste characterization can result in wastes being handled improperly, which can cause personnel injury or environmental damage. Incorrect waste characterization can also lead to fines by state and federal regulating agencies. (ORPS Report ID--LITC-WASTEMNGT-1999-0004)

Investigators determined that the drum was one of four drums of pilot plant waste consisting principally of nitric acid and other nonradioactive hazardous constituents. The waste operator who labeled the sealed drums at a temporary accumulation area (TAA) misinterpreted data in a narrative log and concluded that all four drums had been neutralized to a pH of 6 to 8. Waste operators transferred the drums, including the mislabeled drum, to a treatment, storage, and disposal (TSD) facility, from where it was shipped by truck on August 11, 1998, to the subcontractor's waste management facility in Oregon. The subcontractor then transferred the drums to a facility in California for final treatment and disposal. Waste handlers at the facility in California discovered the labeling discrepancy on September 25, 1998, when they sampled drum contents to ensure that they met pH requirements for process feed. The waste management subcontractor attributed the delay in reporting the discrepancy to personnel error.

The waste management subcontractor does not operate a facility that can process the corrosive waste, nor is it licensed to neutralize the waste. INTEC personnel expect the subcontractor to return the drum to the TSD facility, the point of origin. However, the TSD facility at Idaho is not authorized to neutralize the waste, nor is it authorized to transfer the waste back to the TAA for neutralizing. Facility operators probably will store the drum until they can identify a suitable pathway for disposition.

NFS has reported inadequate waste characterizations in several Weekly Summaries. Following are some examples.

- Weekly Summary 98-18 reported that waste management workers at the Hanford Pacific Northwest National Laboratory had discovered waste that had been incorrectly characterized and shipped over public roads. The waste was shipped as non-RCRA (Resource Conservation and Recovery Act) low-level radioactive waste (DOT Hazard Class 7) instead of as corrosive waste (DOT Hazard Class 8). Investigators determined that the waste generator supplied incomplete data on the contents of one of two 5-gallon waste containers and that waste-sampling procedures were inadequate to accurately characterize the pH of the waste in both containers before shipment. Waste management workers were performing random verification sampling when they discovered that the contents of one of the containers had stratified into two distinct layers. Workers sampled both layers and determined that the bottom layer had a pH of less than 2, which required it to be handled as corrosive, RCRA-regulated mixed waste. Investigators determined that waste generators had not recorded the addition of nitric acid to one of the containers. (ORPS Report RL--PNNL-PNNLBOPER-1998-0004)

- Weekly Summary 98-11 reported that the DOE Office of Enforcement and Investigation issued a Preliminary Notice of Violation under the Price-Anderson Amendments Act to Lawrence Livermore National Laboratory for multiple failures to implement radiological protection requirements and provide the quality controls necessary to protect workers involved in high-efficiency particulate air (HEPA) filter shredding operations. Investigators determined that waste characterization data were available for the shredded HEPA filter but were incorrectly entered on the HEPA filter waste storage box label and on the radioactive waste disposal requisition form. They also determined that no one confirmed the label's accuracy or performed radiological surveys to further characterize the HEPA filter before it was shredded. (NTS Report NTS-SAN--LLNL-LLNL-1997-0001; ORPS Report SAN--LLNL-LLNL-

1997-0038; DOE/OAK-540, Rev. 0, "Type B Accident Investigation Board Report of the July 2, 1997, Curium Intake by Shredder Operator at Building 513, Lawrence Livermore National Laboratory, Livermore, California,")

- Weekly Summary 96-19 reported that the facility manager of the Heavy Water Facility at the Savannah River Site had reported the results of an investigation to determine the source of a tritium release at the Scientific Ecology Group in Oak Ridge, Tennessee. Solid waste facility shippers mistakenly shipped tritium-contaminated process waste filters and resins received from the Heavy Water Facility to the Scientific Ecology Group for compaction. Investigators identified the cause of the event as failure by environmental systems engineering personnel at the solid waste facility to specify and communicate the waste that should be included or excluded from the job control waste. (ORPS Report SR--WSRC-HWFAC-1996-0008)

These events underscore the importance of properly characterizing waste and clearly communicating the information to shippers and waste processors to ensure that hazardous and radioactive wastes are processed as required to prevent environmental release or personnel injury. Waste materials and handling procedures should be well enough defined to eliminate confusion or the need for interpretation, so that everyone who generates, characterizes, packages, stores, or ships waste materials has the same understanding of the waste material requirements. Waste management requirements and guidance can be found in the following references.

- 40 CFR 262.11, *Hazardous Waste Determination*, states that waste may be characterized either by testing it or by applying knowledge of the hazard characteristic of the waste in light of the materials or the processes used. 40 CFR 262.30-33, *Packaging and Marking,* specifies the requirements for proper packaging and labeling of hazardous wastes by waste generators.

- DOE 460.1, *Packaging and Transportation Safety*, establishes safety requirements for packaging and transporting off-site shipments from DOE and for on-site transfer of hazardous materials. Hazardous material shipments are required to be in compliance with DOT hazardous materials regulations in 49 CFR 106-199, *Transportation*, and the applicable tribal, state, and local regulations not preempted by DOT.

- DOE 460.2, *Departmental Materials Transportation and Packaging Management*, establishes DOE policies and requirements to supplement applicable laws, rules, regulations, and other DOE Orders for materials transportation and packaging operations.

- National Research Council Publication ISBN 0-309-05229-7, *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*, 1995, provides guidance and recommendations for the safe handling and storage of chemicals, primarily in laboratory settings. Chapter 7.B.1, "Characterization of Waste," recommends retaining waste in clearly marked containers and states that wastes must be defined clearly on the container. Physical descriptions should include the state of the material, the color, the consistency or viscosity, and the clarity. If the materials are layered, each layer should be described separately. Chapter 7.B.3, "Collection and Storage of Waste," states that every container must be labeled to indicate the identity of the material and its hazard. Although the identity need not be a complete listing of all chemical constituents, it should enable knowledgeable laboratory workers to evaluate the hazard. Information on how to order this book can be obtained from the National Academy Press, 2101 Constitution Avenue,

N.W., Washington, D.C 20418. This book can also be ordered from most larger bookstores.

KEYWORDS: characterization, shipping, waste handling

FUNCTIONAL AREA: Materials Handling/Storage, Waste Management

5. FALL PROTECTION SAFETY VIOLATION

On January 14, 1999, at the Argonne National Laboratory Environmental Research Division, safety representatives observed subcontractor personnel climbing a 200-foot meteorological tower without using the fall protection specified by the safety plan approved for the work. The subcontractor personnel had arrived at the site without double lanyards and personnel retrieval equipment and were not aware that the equipment was required. A site safety professional prohibited them from climbing until they had the required equipment and it had been inspected by site safety representatives. Nevertheless, workers began climbing the tower a few hours later without the required equipment. This occurrence is an example of willful violation of safety requirements. (ORPS Report CH-AA-ANLE-ANLEERD-1999-0002)

Laboratory supervisors immediately stopped the work and collected the workers' badges. They directed them to leave the site and notified them that they could not return. The facility manager notified subcontractor managers by telephone that Argonne National Laboratory would entertain future proposals for work only if company executives visited the site and provided assurance that they would conform to the safety requirements of approved safety plans.

NFS reported a similar occurrence in Weekly Summary 99-01. Safety inspectors at the Argonne National Laboratory observed two subcontracted employees climbing over a guardrail and into the top of a cooling tower without securing their fall protection lanyards to a tie-off point. Their actions could have resulted in a fall of approximately 35 feet. The safety plan in effect required fall protection at all times above 6 feet. Safety representatives issued the workers a warning. The next day, safety inspectors again observed the same two workers climbing over the guardrail and into the cooling tower without securing their lanyards and ordered them to vacate the cooling tower. Laboratory safety personnel and field representatives met with the subcontractor's field supervisors to discuss the incident. The facility issued formal safety violation notices to the subcontractor and suspended the two subcontractor employees for 6 months. The facility project manager informed the subcontractor's corporate office of the violations. ((ORPS Report CH-AA-ANLE-ANLEPFS-1998-0010)

OEAF engineers reviewed similar occurrences involving violation of fall protection safety requirements. Among them are the following.

- A DOE facility representative at the Richland Decontamination and Decommissioning Facility observed a rigger dismantling scaffolding in a valve pit without fall protection. The scaffolding was approximately 30 feet high and extended from the bottom of the valve pit to ground level. The work required the rigger to pass disconnected pieces of scaffolding to workers at the top of the valve pit. The facility representative immediately summoned a safety representative, who stopped the work and discussed fall protection requirements with the rigger. The rigger obtained a harness and lanyard and completed the job without mishap. Investigators determined that the rigger had received training in fall protection

requirements and management expectations. Facility managers held the rigger accountable for the infraction and took disciplinary action. (ORPS Report RL--BHI-DND-1999-0001)

- An electrical worker at the Rocky Flats Plutonium Processing and Handling Facility was injured when he fell while pulling wire through a conduit in a ceiling. The worker was standing on an 8-foot-high metal electrical cabinet that he was using as a work platform when he fell. Investigators determined that his work package required the use of harnesses. The harnesses were located in the room where work was being performed, but the worker had not used them. (ORPS Report RFO--KHLL-371OPS-1998-0007)

DOE site operators require both their own personnel and subcontracted personnel to submit safety plans for any work that might involve environmental, safety, or health hazards. Safety professionals review the safety plans for adequacy and approve them. Contract provisions require the prime contractor and subcontractors to adhere to safe work practices and to observe safety requirements. Work control procedures require pre-job briefings for workers so that they understand safety requirements. Nonetheless, willful violations of fall protection and other safety requirements occur regularly throughout the complex.

DOE O 4330.4B, *Maintenance Management Program*, chapter II, section 8.3.6, "Control of Non-Facility Contractor and Subcontractor Personnel," states that nonfacility contractor and subcontractor managers should be held accountable for the work performed by their personnel. Section 8.3.3 requires maintenance supervisors to routinely monitor maintenance activities, including industrial safety practices, to ensure they are in accordance with DOE and facility policies and procedures. The actions taken by Argonne National Laboratory personnel are consistent with these barriers to the neglect of safety requirements. Conscientious surveillance allowed early detection of a safety violation in progress and caused work to be stopped before an accident occurred. The safety violation notices issued to subcontractor management will seriously impact business opportunity.

KEYWORDS: construction, fall protection

FUNCTIONAL AREAS: Construction, Industrial Safety

6. LIQUID RADIOACTIVE WASTE LEAKS INTO A WORK AREA

On December 14, 1998, at the Hanford Analytical Laboratory, liquid radioactive waste leaked into a newly installed stainless steel liner. The problem was discovered after a health physics technician found contamination on the respirators of two laborers exiting the work area. Technical reviewers failed to recognize that a waste line leading to the cell, which work planners assumed was an inactive spare, was an active line. Inadequate pre-job planning exposed workers to an increased risk of contamination and may have resulted in liquid waste leaking into the work area. (ORPS Report RL--PHMC-ANALLAB-1998-0050)

Investigators determined that the waste line was designed to be a spare and was shown as such on the project drawings. However, project personnel did not communicate this configuration to facility operations personnel at project turnover, and the line was put in use. Investigators also determined that if the technical reviewers had walked down the job, they probably would have discovered that the drain line was active. The operations manager placed an administrative hold on operational activities in the hotcells that drain to these lines and ordered the water supply to the hotcells to be locked out pending further investigation into this event.

NFS has reported on configuration control and work control deficiencies in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-08 reported that an inadequate procedure allowed a valve to remain open, affecting the sparging of plutonium nitrate solution at the Rocky Flats Environmental Technology Site. The open valve decreased system vacuum and affected the sampling and movement of a solution that has criticality safety implications. Investigators determined that this occurrence was the result of an inadequate review of system drawings and a less-than-adequate walk-down of the system during development of the procedure. (ORPS Report RFO--KHLL-771OPS-1997-0009)

- Weekly Summary 97-03 reported that a subcontractor communications technician at the Oak Ridge Y-12 Site inserted a "fish tape" into the wrong conduit, where it contacted an energized 13.8-kV electrical switch box. The technician was installing communication cables using approved work package drawings. An incorrect drawing resulted in an electrical near miss. (ORPS Report ORO--USW-ORFICNY12-1997-0001)

These events illustrate the importance of having a thorough and disciplined configuration management program. Facility managers should ensure that all personnel are made aware of the need for detailed modification reviews and for a stringent configuration management change control process, even for non-vital systems. This event also underscores the important role of the work planners and reviewers in developing work plans. Work planners should review up-to-date drawings and enlist the support of subject matter experts as necessary. They should also walk down the system to identify potential hazards and verify that the work can be performed correctly based on actual equipment location, proper labeling, and valid procedures. Walk-downs can also aid in verifying the accuracy of drawings. The following references discuss configuration control and work planning.

- DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter VIII, "Control of Equipment and System Status," states that managers of DOE facilities shall establish administrative control programs to handle configuration changes resulting from maintenance, modifications, and testing.

- DOE-STD-1050-93, *Guideline to Good Practices for Planning, Scheduling and Coordination of Maintenance at DOE Nuclear Facilities,* section 3.1.1.3, provides the key elements of an effective planning program. The standard includes guidance recommending that experienced individuals conduct thorough reviews of work plans to eliminate any errors or confusion.

- DOE-STD-1073-93-Pt.1 and -Pt.2, *Guide for Operational Configuration Management Program Including the Adjunct Programs of Design Reconstitution and Material Condition and Aging Management*, states that walk-downs should be performed to determine the degree of agreement between the actual physical configuration and the configuration shown on the facility documentation. The standard discusses the control of modifications that can lead to temporary or permanent changes in design requirements, facility configuration, or facility documentation. The standard discusses identifying changes, conducting technical and management reviews, and implementing and documenting changes.

KEYWORDS: configuration control, drawings, work planning

FUNCTIONAL AREAS: Configuration Control, Work Planning

7. SEALED SOURCE HANDLED IMPROPERLY

On January 11, 1999, at the Lawrence Livermore National Laboratory, an employee transported an x-ray fluorescence detector unit between buildings without following Laboratory policies for handling sealed sources. The detector is a portable unit with a carrying case that is approximately the size of a laptop computer. It was not entered into the Laboratory's Materials Management Division (MMD) accountable inventory database and was not labeled as an accountable sealed source. The lack of accountability and monitoring of sealed sources can result in lost sources, improperly discarded sources, and failed source integrity, which can lead to the spread of contamination and personnel exposure. (ORPS Report SAN--LLNL-LLNL-1999-0002)

When shipping personnel reviewed a shipping request for the detector, they realized that the detector needed to be processed by MMD because of its radioactive material content. The detector contains an Am-241 sealed source that the Laboratory Health and Safety Manual states is a Class IV sealed source. Class IV sources are the most radioactive and require tracking by MMD. Laboratory procedures require Class IV sealed sources to be transported between on-site buildings by MMD personnel. Shipping personnel made the appropriate notifications in accordance with Laboratory procedures. An Environment, Safety, and Health technician took possession of the detector, surveyed it for external contamination, secured it in a locked radioactive materials area, and filled out a controlled material identification tag. MMD personnel then took possession of the detector and placed it in the MMD vault for appropriate storage. Investigators determined that the detector had been procured in 1997 but was never entered into the MMD accountable inventory database, as required by existing Laboratory procedures. Investigators will try to find why the detector was not entered into the MMD database and will develop appropriate corrective actions.

NFS has reported on occurrences in which sealed sources were not registered with the appropriate organization. Following are some examples.

- Weekly Summary 98-06 reported the loss of accountability of a sealed, 150-mCi tritium source at the Rocky Flats Environmental Technology Site. The source was contained in an electron-capture detector and installed in a gas chromatograph. Property utilization and disposal personnel discovered the source and notified radiological control personnel because they recognized the trefoil symbol. Investigators believe that when site personnel received the gas chromatograph from the manufacturer in the late 1980s they were unaware that it contained a sealed source, so it was not registered with the Rocky Flats source registrar. (ORPS Report RFO--KHLL-FACOPS-1998-0002)

- Weekly Summary 97-34 reported that a facility manager at the Sandia National Laboratory discovered that a gas chromatograph containing a 150-mCi tritium source was not registered in the site source registry. Investigators determined that a source custodian did not register it when it was received from the manufacturer, resulting in a loss of accountability of the sealed source. (ORPS Report ALO-KO-SNL-6000-1997-0007)

These events underscore the importance of strict accountability for radioactive sources and demonstrate the need for a strong radioactive source control program. If the detector had been properly entered into the MMD database, it would have been appropriately labeled and stored, and existing handling requirements would more likely have been used to properly move it between buildings. All radioactive materials have specific handling requirements. DOE maintains a regulatory position paper on sealed radioactive source controls that delineates

proposed requirements similar to those of the NRC. The position paper states that "these requirements were determined to be necessary for an adequate radiation protection program."

Personnel responsible for the control of radioactive sources at DOE facilities should review the following guidance to ensure adequate accountability for sources.

- DOE N 441.1, *Radiological Protection for DOE Activities*, requires control of and accountability for sealed radioactive sources. The Notice establishes radiological protection program requirements that, combined with 10 CFR 835 and its associated implementation guidance, form the basis for a comprehensive radiological protection program. There are 16 top-level, performance-based requirements in this Notice. These 16 requirements supplement and enhance the requirements of 10 CFR 835 to provide critical direction in the areas of administrative controls, radiation safety training, work authorizations, posting, exposure of minors, and sealed radioactive source accountability. DOE N 441.4, *Extension of DOE N 441.1, Radiological Protection for DOE Activities,* extends DOE N 441.1 until June 30, 2000.

- DOE/EH-256T, *Radiological Control Manual,* requires control and accountability for sealed radioactive sources. It states that each person involved in radiological work is expected to demonstrate responsibility and accountability through an informed, disciplined, and cautious attitude toward radiation and radioactivity. The manual sets forth DOE guidance on the proper course of action in the area of radiological control, including work preparation; work controls; monitoring and surveys; and training and qualifications. Section 123, "Worker Responsibilities," states that trained personnel should recognize that their actions directly affect contamination control, personnel radiation exposure, and the overall radiological environment associated with their work.

- DOE Implementation Guide G-N 5400.9/M1-Rev.1, *Sealed Radioactive Source Accountability and Control*, provides guidance for establishing and operating a sealed source accountability and control program. Specific guidance includes organization and responsibilities, receipt, labeling and storage, inventory, integrity testing, and handling and disposal.

Links to DOE radiation protection documents, including the sealed source position paper, can be found at http://tis-nt.eh.doe.gov/wpphm/regs/regs.htm. The NRC maintains a sealed source database. The database can be found at http://www.NRC.gov/NRC/FEDWORLD/NRC-SSD/index.html. This database provides a list of sealed sources licensed by the NRC and a variety of information on sealed sources.

KEYWORDS: sealed source, accountability, radiation protection

FUNCTIONAL AREAS: Radiation Protection

OEAF FOLLOW-UP ACTIVITY

1. CORRECTION TO WEEKLY SUMMARY 98-52, ARTICLE 3

Article 3, "Carbon Monoxide Contamination in Breathing Air System," in Weekly Summary 98-52 requires the following clarification and correction. The last sentence of the second paragraph states that the OSHA Permissible Exposure Level (PEL) for CO in compressed breathing air is 10 ppm. The limit of 10 ppm is not an OSHA PEL, but the maximum allowed content for Grade

D breathing air as given in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989. This distinction is made in the sixth paragraph of the article. Also, in the sixth paragraph of the article, 29 CFR 1910.134 is cited incorrectly as 10 CFR 1910.134.

KEYWORDS: breathing air, industrial safety, respirator

FUNCTIONAL AREAS: Industrial Safety